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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

CHEN, TIANJIE

ART UNIT	PAPER NUMBER
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2652

DATE MAILED: 08/23/2004

7

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/943,859

Applicant(s)

SIN ET AL.

Examiner

Tianjie Chen

Art Unit

2652

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04 June 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

Final Rejection

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

1. Claims 1, 11, 13, and 15 are rejected under 35 U.S.C. 102(e) as being anticipated by Redon et al (US 6,381,107).

With regard to claims 1 and 11, Redon et al shows a hard bias spin-dependent tunneling sensor and a method of manufacturing in Figs. 1-9 including: a first lead 81 (Column 5, line 3); a hard magnet 61 (Column 8, lines 52-53) over the first lead; a free layer 20 (Column 4, line 42) over the hard magnet 61 and overhanging the hard magnet; a tunneling barrier layer 30 (Column 4, line 41) over the free layer; a first pinned layer over 41 the tunneling barrier layer; a nonmagnetic coupling layer 42 over the first pinned layer; a second pinned layer 43 over the nonmagnetic coupling layer (Figs 1 and 9; column 4, line 49 and column 8, lines 18-21); a pinning layer 50 (Column 4, line 53) over the second pinned layer; and a second lead 85 (Column 5, line 3) over the pinning layer.

Art Unit: 2652

With regard to claim 13, Redon et al further shows that the hard magnet 61 is formed around and in contact with a first gap spacer 71 (Fig. 1; column 5, line 51-53).

With regard to claim 15, Redon et al further an insulator 93 (Fig. 1; column 10, line 53) over the hard magnet 61 and around the free layer 20, the tunneling barrier layer 30, the first pinned layer 41, the nonmagnetic coupling layer 42, the second pinned layer 43, and the pinning layer 50.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 2, 6, 7, 12, 16-18, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Redon et al.

With regard to claims 2 and 12, Redon et al further shows a first gap spacer 71 over the first lead 81 (Column 5, lines 51-53); and a second gap spacer 75 over the pinning layer; but fails to show the free layer is equally spaced from the first and second leads.

However, Redon et al shows that the gap layers 71 and 75 have functions of adjusting a distance between the shield (i.e. the leads), adjusting the position of the TMR multilayered film and preventing the ununiform tunnel current (Column 5, lines 51-56).

Art Unit: 2652

It would have been obvious at the time the invention was made to one of ordinary skill in the art to adjust the thickness of the gap layers, which would include the case of the free layer is equally spaced from the first and second leads (i.e. shield). The rationale is as follows: Applicant does not disclose any unexpected result from setting the "equidistance." Redon et al shows that the gap layers 71 and 75 have functions of adjusting a distance between the shields, adjusting the position of the TMR multilayered film and preventing the ununiform tunnel current (Column 5, lines 51-56). One of ordinary skill in the art would have been motivated to adjust the thickness for adjusting the position of TMR and prevent the ununiform of the tunneling current. The results would includes the case of the free layer is equally spaced from the first and second leads.

With regard to claims 6 and 16, Redon et al shows a hard bias spin-dependent tunneling sensor and method of manufacturing including: an inherent substrate; a shield/first lead 81 of a conductive material over the substrate; a hard magnet 61 containing a material CoPt (Column 8, lines 52-53), which is selected from a group consisting of cobalt, chrome, platinum, tantalum, and a combination thereof over the shield/first lead; a free layer 20 of NiFe (Column 8, lines 7, lines 16-20) containing a material selected from a group consisting of cobalt, iron, nickel, and a combination thereof over the hard magnet and overhanging the hard magnet; a tunneling barrier layer 30 containing a material alumina (Column 7, lines 66-67) selected from a group consisting of aluminum, chromium, an oxide, a nitride, and a combination thereof over the free layer; a pinning layer 50 containing RuRhMn selected from a group consisting of platinum, palladium, manganese, iron, nickel,

Art Unit: 2652

iridium, an oxide, and a combination thereof over the second pinned layer; and a shield/second lead 85 of a conductive material over the pinning layer 50.

Redon et al does not specify the material of the first pinned layer, non-magnetic coupling layer, and second pinned layer.

However, Redon et al teaches that the synthetic ferromagnetic layer of 22 can be used for layer 40. the layer 20 has a first pinned layer containing a material NiFe selected from a group consisting of cobalt, iron, nickel, a non-magnetic coupling layer containing ruthenium over the first pinned layer; a second pinned layer containing a material NiFe selected from a group consisting of cobalt, iron, nickel, and a combination thereof over the non-magnetic coupling layer (Column 8, lines 7-22);

One of ordinary skill would have been motivated to apply same structure to the pinned layer 40.

With regard to claims 7 and 17, Redon et al further shows a first gap spacer of a nonmagnetic, hard, conductive material Rh (Column 5, lines 51-52) over the shield/first lead; and a second gap spacer 75 of a nonmagnetic, hard, and conductive material, and expect the free layer is equidistant from the shield/first lead and the shield/second lead for the same reason described above.

With regard to claim 18, Redon et al further shows that the hard magnet 61 is formed around and in contact with the first gap spacer 71.

With regard to claim 20, Redon et al further shows that an insulator 93 over the hard magnet and around the free layer, the tunneling barrier layer, the first pinned layer, the non-magnetic coupling layer, the second pinned layer and the pinning layer.

Art Unit: 2652

3. Claims 3, 5, 8, and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Redon et al in view of Khan et al (US 6,495,311).

With regard to claims 3 and 8, Redon et al's method includes: forming first gap layer; and forming the hard magnet includes forming the hard magnet around the first gap spacer.

With regard to claims 5 and 10, Redon et al's method includes: forming the free layer, the tunneling barrier layer, the first pinned layer, the nonmagnetic coupling layer, and the pinning layer; and including: forming an insulator over the hard magnet and around the free layer, the tunneling barrier layer, the first pinned layer, the nonmagnetic coupling layer, the second pinned layer and the pinning layer.

Redon et al does not show that bilayer process is used in the methods.

Khan shows a method of manufacturing magnetic head, wherein bilayer process is used in manufacturing (Column 2, lines 45-49).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to use bilayer process in Redon et al's method of manufacturing. The rationale is as follows: Khan et al teaches that the bilayer process can be used to form a clean edge for the layer deposited (Column 2, lines 45-49). One of ordinary skill in the art would have been motivated to use bilayer process to obtain a clean edge for the layers.

4. Claim 14 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Redon et al in view of Fukuzawa et al (US 6,146,776).

Art Unit: 2652

With regard to claim 14; Redon et al further shows that the first lead 81 has a recess provided; and the hard magnet 61 is formed in the recess.

With regard to claim 19, Redon et al further shows that the shield/first lead 81 has a recess provided therein; and including: the hard magnet 61 is formed over the seed layer; and the free layer 20 is formed in contact with the hard magnet 61.

Redon et al fails to show that the hard magnet is formed on a seed layer.

Fukuzawa et al shows a magnetic head, wherein the hard magnet later 23 is formed on a seed layer 22 (Column 12, lines 25-31).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to add the seed layer taught by Fukuzawa et al into Redon et al's device. The rationale is as follows: Fukuzawa et al teaches by using the seed layer 22 for the hard magnetic layer, $H_{k\text{grain}}$ can be fully enhanced (Column 12, lines 30-31). One of ordinary skill in the art would have been motivated to use the seed layer to enhance $H_{k\text{grain}}$ of the hard magnetic layer.

5. Claims 4, and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Redon et al in view of Khan et al and Fukuzawa et al (US 6,146,776).

With regard to claims 4 and 9, Redon et al and Khan' method includes: forming the shield/first lead includes using a bilayer process forming a recess therein; forming the hard magnet in the recess of the first lead; and forming the hard magnet includes forming a hard biasing material.

Redon et al fails to show that the hard magnet is formed on a seed layer.

Art Unit: 2652

Fukuzawa et al shows a magnetic head, wherein the hard magnet later 23 is formed on a seed layer 22 (Column 12, lines 25-31).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to add the seed layer taught by Fukuzawa et al into Redon et al's device for the same reason described above.

Response to Arguments

6. Applicant's arguments filed 06/04/2004 have been fully considered but they are not persuasive.

- In Redon et al (US 6,381,107)'s Fig. 1, the free layer is 20, which is "overhanging the hard magnet" 61. The distance D, which Applicant argues, has nothing to do with the free layer 20.

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Art Unit: 2652

Any inquiry concerning this communication or earlier communications assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217from the examiner should be directed to Tianjie Chen whose telephone number is (703) 305-7499. The examiner can normally be reached on 8:00-4:30, Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hoa Nguyen can be reached on (703) 305-9687. The fax phone number for the organization where this application or proceeding is - 9197 (toll-free).


TIANJIE CHEN
PRIMARY EXAMINER